

SECTION 15080

THERMAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Scope

1. Provide the various types of thermal insulation as shown, scheduled or specified. Include all accessories and components for properly functioning installations.

B. Piping Systems Thermal Insulation

1. INDOOR

- a. Piping systems fibrous glass insulation:

MINIMUM INSULATION THICKNESS FOR PIPE SIZES*

Piping System Types	Fluid Temp. Range degF	Runouts Up to 2 in. and 8 ft. length	1 and Less	1-1/4 to 2	2-1/2 to 4	5 and 6	8 and Larger
<u>Heating Systems</u>							
<u>Steam & Hot Water</u>							
High Pressure/Temp	306-450	1.5	2.5	2.5	3.0	3.5	3.5
Medium Pressure/Temp	251-305	1.5	2.0	2.5	2.5	3.0	3.0
Low Pressure/Temp	201-250	1.0	1.5	1.5	2.0	2.0	2.0
Low Temperature	120-200	0.5	1.0	1.0	1.5	1.5	1.5
Steam Condensate	Any	1.0	1.0	1.5	2.0	2.0	2.0
Steam and Condensate	Any	1.0	1.0	1.0	1.0	1.0	1.0
Vents							
Domestic Hot Water	50-150	1.0	1.0	1.0	1.5	1.5	1.5
Hot Compressed Air	300	1.5	2.0	2.5	2.5	3.0	3.0

* Insulation thickness based on insulation having thermal resistances in range of 4.0 to 4.6 h x F x sq. ft./BTU per inch of thickness on a flat surface at a mean temperature of 75 degF.

- b. Piping systems phenolic foam or polyisocyanurate insulation:

MINIMUM INSULATION THICKNESS FOR PIPE SIZES*

Piping System Types	Fluid Temp. Range degF	1 and Less	1-1/4 to 2	2-1/2 to 4	5 and 6	8 and Larger
<u>Cooling Systems</u>						
Chilled Water	40-55	0.5	0.75	1.0	1.0	1.0
Cooling Tower Water	80-95	0.5	0.75	1.0	1.0	1.0

- c. Calcium silicate insulation for installation at Steam pressure regulating stations:

MINIMUM INSULATION THICKNESS FOR PIPE SIZES*

Piping System Types	Fluid Temp. Range degF	1 and Less	1-1/4 to 2	2-1/2 to 4	5 and 6	8 and Larger
Heating Systems						
<u>Steam</u>						
High Pressure/Temp	306-450	5.0	5.0	5.0	5.5	5.5
Medium Pressure/Temp	251-305	4.5	4.5	4.5	5.0	5.0
Low Pressure/Temp	201-250	3.0	3.0	3.5	3.5	3.5

- d. Piping systems cellular elastomer insulation:

MINIMUM INSULATION THICKNESS FOR PIPE SIZES

Piping System Types	Up to 2"	Over 2" to 4"	Over 4" to 6"	Over 6" to 8"
Cold Water	1/2"	1/2"	1/2"	3/4"
Roof Drains	1/2"	1/2"	1/2"	3/4"
Storm Drains	1/2"	1/2"	3/4"	3/4"
Chilled Water	1/2"	3/4"	1"	1"
Cooling Tower Water	1/2"	3/4"	1"	1"
Condensation Drain	1/2"	3/4"	--	--

2. OUTDOOR

- a. Piping systems shall be insulated with the following insulation thickness, heat traced as indicated and covered with a sealed aluminum jacket as follows:
- 1) All services. Indoor thickness plus 1/2 inch, unless otherwise indicated on the DRAWINGS.

3. PIPING SYSTEMS ACCESSORIES AND EQUIPMENT

- a. Hot Water Heating Converters and Condensate Tanks: Fibrous glass or calcium silicate, 2 inches minimum thickness.
- b. Chilled Water Pumps: Cellular elastomer, 1 inch minimum thickness. At CONTRACTOR'S option, 1 inch minimum thickness insulating cement covered with UL Listed vapor barrier jacket with outer seal coat.
- c. Condensate Pumps: Calcium silicate, 1 inch minimum thickness. At CONTRACTOR'S option, 1 inch minimum thickness insulating cement covered with UL Listed outer seal coat.
- d. Water Chillers:
 - 1) Cellular elastomer, 1 inch minimum thickness for surfaces not factory insulated having a temperature of 55 degF or less.
 - 2) Fibrous glass, 1-1/2 inch minimum thickness for surfaces not factory insulated having a temperature of 55 degF or less.

C. Piping Systems Anti-Condensation Insulation

1. GENERAL

- a. Systems subject to exterior condensation because of internal fluids and pipe exterior ambient conditions shall be insulated per the following minimum thickness with a vapor barrier.

2. PIPING SYSTEMS INSIDE BUILDINGS

	Piping System	Min. Thickness (inches)	Remarks
a.	Cold Domestic (Potable) Water	1	Fibrous glass
b.	Plant or Service Water	1	Fibrous glass
c.	Coil Drain Piping	1	Fibrous glass
d.	Rain Conductors	1/2	Fibrous glass
e.	Sanitary Waste	1	Fibrous glass

3. PIPING SYSTEMS ACCESSORIES AND EQUIPMENT

- a. Roof Drain Body. Cellular elastomer, 3/8 inch thick with vapor tight junction between drain body and rain conductor piping insulation.
- b. Cold Water Pumps. Same as Chilled Water Pumps.

D. Air Handling Systems Thermal Insulation

1. INDOOR

- a. Air handling systems surfaces insulation thickness:

Cooling (degF)	Flex Duct Wrap Faced & Unfaced	Rigid Board Faced & Unfaced
Down to 55	1.5	1
54 - 45	1.5	1
44 - 35	2	1
	2	1-1/2
	3	1-1/2
	3	1-1/2
	3	2

- b. Insulation R-Values shall conform to requirements of ASHRAE 90.1, Table 6.8.2.
- c. Ducts, plenums, enclosures and fans not installed in enclosures shall be thermally insulated to extent indicated.
- 1) Rigid fibrous glass with vapor barrier and factory applied jacket where exposed to view.
 - 2) Flexible fibrous glass with vapor barrier where concealed from view.
 - 3) Flexible fibrous glass with vapor barrier and glass cloth jacket.

E. Miscellaneous Surfaces Thermal Insulation

1. PIPING AT HANDICAPPED LAVATORIES

- a. Molded closed cell vinyl cover assembly, 1/2 inch minimum thickness, for hot water and drain piping from lavatory to wall.

- F. Related Work Specified Under Other Sections
 - 1. Division 15 Section “General Mechanical Requirements.”

1.2 SUBMITTALS

- A. Furnish submittals for items that are identified in this SECTION by a different typeface and a bracketed code (e.g., *Item [L]*). Refer to Division 01 Section “Shop Drawings, Product Data And Samples” for definition of codes for types of submittals and the administrative requirements governing submittal procedure. Additional submittal requirements pertaining to this SECTION are specified herein under this Article.
- B. Show provisions for obtaining required performance under project service conditions.
- C. Shop drawings for adhesives, coatings, mastics, sealants and solvents shall be accompanied by a MATERIAL SAFETY DATA Sheet similar to Form OSHA-174. Where flammable product application performance requirements are such that a non-flammable substitute would fail, submit alternative product with complete information for approval.
- D. *Test Reports [P,T]*: Provide copies of performance test data.
- E. Certificate: Submit certificate that materials performance data to be applicable under project service conditions.

PART 2 PRODUCTS

2.1 GENERAL

- A. Provide noncombustible thermal system materials per NFPA 255 and ASTM E 84. Provide insulation with a Flame Spread Classification of 25 and a maximum Smoke Developed Classification of 35, 50 (fibrous glass), or 150 (cellular elastomer).

2.2 CALCIUM SILICATE

- A. *Asbestos-free hydrous calcium silicate [P]*: With mineral binder, reinforcing fiber and free chloride ion content of less than 300 PPM and per ASTM C 533. Fittings insulation per ASTM C 450.
- B. Piping insulation:
 - 1. Johns Manville Corp. “Thermo-12 Calcium Silicate”.
 - 2. Calsilite Corp. “Calsilite Insulation”
 - 3. PABCO Corp. “ SuperCaltemp, Type NA”.
- C. Block insulation:
 - 1. Johns Manville Corp. “Thermo-12”.
 - 2. Calsilite Corp. “Calsilite Insulation”
 - 3. PABCO Corp. SuperCaltemp, Type NA”..

2.3 CELLULAR ELASTOMER

- A. *Cellular elastomer [P]*: Insulation shall conform to ASTM C534 and have thermal conductivity not greater than 0.30 Btu-inch/hour, square foot, degF. at 75 deg. mean temperature and vapor permeability (ASTM C355), not greater than 0.20 perm inch. In thicknesses of 1" and less, it shall have a flame spread classification (ASTM E84, NFPA 255) not greater than 25, and specific optical smoke density (NFPA 258) averaging not greater than 270.
1. Armacell, Armaflex II.
 2. Johns Manville, Aerotube AP and II.
 3. Rubatex, R-180-FS
- B. Insulation thicknesses shall be as listed in Article 1.1.
- C. Contact adhesive shall be as supplied by the insulation manufacturer.
1. Armacell, 520 Adhesive.
 2. Johns Manville, 57 Adhesive.
 3. Rubatex, 373 Adhesive.

2.4 FIBROUS GLASS

- A. *Ductwork insulation [P]*: Fiberglass blanket insulation shall conform to ASTM C553 and have thermal conductivity not greater than 0.32 Btu - inch/hour - square foot - Degree F. at 75 Degree F. mean temperature. Vapor barrier facing shall be a laminate of minimum 1 mil thickness aluminum foil exterior surface, glass fiber reinforcement, and kraft paper. The facing shall have water vapor permeance (ASTM E96, Procedure A) not greater than 0.5 perms.
1. CertainTeed, Type 75 FSK Standard Duct Wrap.
 2. Johns Manville, R-Series Microlite with FSK.
 3. Knauf, Duct Wrap with Multi-Purpose FSK.
 4. Owens/Corning, All Service Faced Duct Wrap.
- B. *Ductwork insulation [P]*: Insulation board shall conform to ASTM C612 Class 2 and have thermal conductivity not greater than 0.26 Btu - inch/hour - square foot - Degree F. at 75 Degree F. mean temperature. Density of insulation board shall be 6.0 lbs/cubic foot. Vapor barrier facing shall be a laminate of white kraft paper exterior surface, glass fiber reinforcement, and minimum 1 mil thickness aluminum foil. The facing shall have water vapor permeance (ASTM E96, Procedure A) of not more than 0.2 perms and puncture resistance (ASTM D781) not less than 50 units.
1. CertainTeed, 1B600 ASJ Industrial Insulation Board.
 2. Johns Manville, Type 817 AP Spin-Glas.
 3. Knauf, 6PCF-ASJ Insulation Board.
 4. Owens/Corning, Type 705 ASJ-25 Fiberglas Insulation.
- C. *Piping barrel insulation [P]*: Insulation shall conform to ASTM C547 Class 1 and have thermal conductivity not greater than 0.26 Btu-inch/hour, square foot, deg. F at 75 deg. F. mean temperature. Vapor barrier jacket shall be a laminate of white kraft paper exterior surface, glass fiber reinforcement, and minimum 1 mil thickness aluminum foil. The jacket shall have

water vapor permeance (ASTM E96, Procedure A) of not more than 0.02 perms, and puncture resistance (ASTM D781) not less than 50 units.

1. Johns Manville, Micro-Lok AP-T Plus.
2. Knauf, ASJ/SSL Pipe Insulation.
3. Owens/Corning, Fiberglass ASJ/SSL-II

D. *Pipe fitting insulation [P]*: Insulate flanges, couplings, fittings, and valves with either fiberglass blanket insulation or segments of pipe insulation, secured with 20 gage annealed stainless steel wire and given a smoothing coat of insulating and finishing cement. Thickness of insulation on fittings and valves shall be equal to that on the adjacent pipe. Thermal conductivity of fiberglass blanket insulation shall not be greater than 0.28 Btu. inch/hour, square foot, deg. F. at 75 deg F. mean temperature (density 1.0 PCF). Insulating and finishing cement shall be as supplied by the following approved manufactures under these trade names:

1. Celotex, MW-1 Insulating and Finishing Cement.
2. Pabco, Pabcote One Coat Insulating Cement.

E. *Hot equipment insulation [P]*: Insulation board shall conform to ASTM C612 Class 2 and shall have thermal conductivity not greater than 0.26 Btu - inch/hour - square foot - Degree F. at 75 Degree F. mean temperature and not greater than 0.35 Btu - inch/hour - square foot - Degree F. at 200 Degree F. mean temperature.

1. CertainTeed, 1B600 ASJ Industrial Insulation Board.
2. Johns Manville, Type 817 Spin-Glas.
3. Knauf, 6PCF-ASJ Insulation Board.
4. Owens/Corning, Type 705 ASJ Fiberglas.

2.5 PHENOLIC FOAM

A. *Chemically neutral phenolic foam insulation [P]*: Insulation manufactured as a continuous rigid molding with laminated minimum 1 mil thickness aluminum foil and Kraft paper vapor barrier jacket. Flame spread rating 25 or less and smoke developed rating 50 or less by ASTM E 84. Foam alone shall have flame spread rating not exceeding 10 and smoke developed rating not exceeding 15. Thermal conductivity of 0.12 at 40 degF and 0.13 at 75 degF. and suitable for temperatures of minus 290 to plus 250 degF.

1. Resolco, "Insul-Phen".
2. Tarec, "Ecophen".

2.6 POLYISOCYANURATE FOAM

A. Polyurethane modified polyisocyanurate cellular foam insulation manufactured as a continuous rigid molding with factory applied All-Service Jacket (ASJ) vapor retarder. UL Listed. Service temperature range of -297°F to +300°F (-183°C to +149°C). ASTM E 84 flame spread rating 25 and smoke developed rating 50. ASTM C518 k-Factor of 0.141 at 75°F (24°C).

1. Dow "Trymer 2000".
2. Other approved.

2.7 MOLDED CLOSED CELL VINYL

- A. Provide one-piece molded closed cell vinyl protective cover assembly per ADA4.19.4 and ANSI A117.1.
 - 1. Plumberex “Pro-Extreme.”
 - 2. Other approved.

2.8 REMOVABLE/REUSABLE INSULATION

- A. Provide custom designed removable/reusable insulation blankets where specified. Comply with MICA Standards where indicated.
- B. Insulation shall be fiberglass mat insulation or cellular elastomer as specified.
- C. Fibrous glass insulation shall be encased in an inner and outer jacket of Teflon or silicone rubber impregnated fiberglass fabric suitable for temperatures to 500 degF. Minimum weight of fabric shall be 14 ounces per square yard. Fabric shall comply with UL 214 flammability test.
- D. Cellular elastomer insulation for indicated pumps shall be used as metal liner per MICA Plate No. 48.
- E. Manufacture:
 - 1. MIT International Inc. Houston, TX.
 - 2. Performance Contracting, Inc., Lenexa, Kansas.

2.9 JACKETS AND ACCESSORIES

- A. Aluminum: For piping outside buildings weatherproof the insulation with 0.016” thick alloy 3003 aluminum jacketing with longitudinal lock seam and butt strap circumferential joints. Jacketing is to be as supplied by the following manufacturers under these trade names:
 - 1. Childers, Lock-On.
 - 2. Pabco, Surefit.
- B. Stainless Steel: AISI Type stainless steel, smooth, 0.010 inches thick with manufacturer’s standard vapor barrier.
 - 1. Childers “Lock-On”.
 - 2. Insul-Coustic “Metal-Clad”.
- C. Polyvinylchloride, 0.010 inches thick, per FS L-P-535, Composition A. Type II, manufacturer’s standard color. Use manufacturer’s standard joint adhesive.
 - 1. Johns Manville Corp. “Zeston”.
 - 2. Other approved.

- D. Fittings Jackets:
1. Polyvinylchloride, 0.010 inches thick, per FS L-P-535, Composition A, Type II, manufacturer's standard color. Use manufacturer's standard joint adhesive.
 - a. CEEL-CO "Light-Gage".
 - b. Proto Corp. "LoSmoke".
 - c. Johns Manville Corp. "Zeston".
 2. Aluminum, approximately 0.032 inches thick, smooth, two piece.
 - a. General Aluminum Supply Corp., Kansas City, Mo.
 - b. Other approved.
 3. Stainless Steel. AISI Type stainless steel, smooth, 0.010 inches thick.
 - a. Childers "Univers-Ell Jacs".
 - b. Other approved.
- E. Straps: AISI Type stainless steel, 15 mils thick, 1/2 inch wide.
- F. Joint sealant: Aluminum pigmented butyl polymer.
1. Foster Div., H. B. Fuller Co., "Elastolar Sealant, Aluminum 95-44".
 2. Childers "Chil-Joint CP-70".

2.10 MISCELLANEOUS MATERIALS

- A. *Insulating and Finishing Cement [P]:*
1. Celotex MW-1 Insulating and Finishing Cement.
 2. Pabco Pabcote One Coat Insulating Cement.
- B. *Vapor Barrier Mastic [P]:*
1. Childers CP-30.
 2. Vimasco Corp.
- C. *Adhesives [P]:*
1. Foster Div., H. B. Fuller Co. LAGFAS 81-42W or Spark-Fas 85-20.
 2. Vimasco Corp.
- D. *Lagging adhesives [P]:*
1. Foster Div., Amchem Products Inc. "Seal-Fas" 30-36.
 2. Vimasco Corp.
- E. *Sealants [P]:*
1. Foster Div., H. B. Fuller Co., "Elastolar" 95-44.
 2. Vimasco Corp.
- F. *Coatings [P]:*
1. Foster Div., H. B. Fuller Co. Monolar/Weather Rite 46-50.
 2. Vimasco Corp.

- G. *Glass cloth [P]*: Plain weave per ASTM D 579 Type 723 or 723.1. Weight not less than 7.23 ounces per yard before sizing.
- H. *Glass lagging tape [P]*: Elastic knitted cloth per MIL-C-20079, Type II Class 3. Weight 11 ounces per yard.
 - 1. Foster Div., H. B. Fuller Co. "Seal-Fas" Glass Lagging Tape.
 - 2. Other approved.
- I. Wire: Annealed, 18 gage, Type 430 or 304 stainless steel.

PART 3 EXECUTION

3.1 WORKMANSHIP

- A. Obtain permission of ARCHITECT-ENGINEER before starting insulation WORK on any piping. Test work shall be completed before insulation WORK is started.
- B. Use insulating materials as specified for each class of service. Where pipes pass through floors or walls, continue insulation through sleeves.

3.2 INSTALLATION

- A. General
 - 1. Apply insulation and jacketing where specified or indicated, per manufacturers published instructions and as specified.
 - 2. Clean surfaces free of oil, grease, dust and deleterious substances before insulation adhesives or mastic are applied. Provide solvent cleaning required to bring surfaces to such condition.
 - 3. Make joints tight, with insulation lengths tightly butted against each other. Where lengths are cut, make cuts smooth and square, without breaking end surfaces. Where insulation terminates, neatly taper ends and seal or finish as specified. Where pipe insulation terminates in finished areas, install chrome plated end caps. Direct longitudinal seams of exposed insulation away from normal view where possible.
 - 4. Shape contours smooth and continuous on exposed work. Smoothly and securely paste down cemented laps and tapes. Apply adhesives on a full-coverage basis except where otherwise specified. Make vapor barrier continuous over vapor sealed insulation.
 - 5. Insulate metal, such as anchors, in contact with low temperature surfaces and projecting beyond the finished insulation surfaces to prevent condensation. Insulate the projecting metal with 1/2 of the specified insulation thickness to a distance not less than 4 times the specified insulation thickness.
 - 6. Insulate pipe lines and equipment surfaces within reach of personnel walking areas and having a surface temperature over 140 degF. Consider "within reach" all areas 7 feet above floors, roofs or walkways or within 3 feet of elevated walkways at the sides.
 - 7. In pedestrian or vehicular traffic areas, protect insulated horizontal pipe 7 feet or less above the floor and insulated vertical pipe from the floor line to 8 feet above the floor with nonintegral jackets and required accessories.

8. Insulate flanges and grooved couplings, when couplings are permitted in insulated systems, the same thickness as the piping or by approved proprietary methods and materials.
9. Install pipe, duct, and equipment insulation, vapor barrier jacket materials, and insulated surface penetrations and seal all joints, surfaces, seams, fittings, valves, etc. to maintain vapor barrier continuity under systems application conditions as specified herein and in accordance with NICA/MICA/trade/manufacturer recommended practice. Seal-off insulation to the pipe, with specified/required/ suitable vapor barrier compound:
 - a. Every 24 feet for on-the-run piping; each branch connection; at all flanges and soft fittings insulation; at all penetrations/terminations and like places where water/moisture ingress/condensation could occur.
 - b. Seal-off to the insulation vapor barrier jacket, fittings/valve enclosures/supports/accessories etc. Isolate support inserts from on-run insulation.
 - c. Typical on-run-of-pipe seals shall be made by bedding insulation bore in two inch wide vapor barrier mastic then sealing abutting faces with vapor barrier to jacket.
 - d. At terminations, seal similarly adding cloth reinforcement and second coat of vapor barrier mastic. Apply similar seals at valve bonnets, supports, piping accessories.
 - e. Provide access scaffolding, for use during insulation application, to prevent damage to vapor barrier/acoustic treatment jackets of piping systems. The OWNER shall repair all such damage prior to acceptance of work.

B. Piping Systems

1. **COLD DOMESTIC WATER, COOLING TOWER WATER AND, CHILLED WATER PIPING**
 - a. Insulate piping per insulation manufacturer's instructions.
 - b. Vapor seal insulation on fitting and valves in cold piping systems and domestic water systems by applying a layer of open weave glass cloth fabric embedded between two flood coats of vapor barrier mastic. Lap fabric 2" onto adjacent pipe insulation.
 - c. Cement laps on longitudinal and butt joints with a vapor barrier adhesive.
 - d. Where indicated on the DRAWINGS, insulate Chilled Water and Cooling Tower Water piping with a 1-inch thickness, combination 6 lb. density insulation over the top 1/2 of pipe, and 3 lb. density insulation on bottom 1/2 of pipe. Cover pipe with two layers of 24 mil aluminum jacketing. Piping installed in Sump Pit shall have jacketing sealed watertight with Type IIR Butyl caulk.
 - e. Where piping is installed outdoors and is Electric Heat Traced, provide two-layer insulation with grooving or routing to accept heat tracing system components profiles and maximum external load bearing strength for heat trace element, process temperature control thermostats and system accessories banding/supports. Coordinate pipe insulation Work with Electric Heat Tracing Work and Division 16, to provide weather tight Work compliant with need for maintenance and inspection access to electrical components enclosed by insulation. Illustrate details in shop drawings.
2. **HOT DOMESTIC WATER PIPING**
 - a. Cement laps on longitudinal seams and butt joints with adhesive. Vapor barrier continuity not required.
 - b. Cover fittings and valves with an approved insulation cement, blocks of an approved insulating material and insulation cement, or mitered segments of the pipe insulation

to a thickness equal to that of the adjacent pipe insulation. On fittings and valves, install an outer jacket of glass cloth with adhesive.

3. **HOT COMPRESSED AIR AND STEAM AND CONDENSATE PIPING**

- a. Install factory jacketed fibrous glass insulation per manufacturer's instructions.
- b. Cover calcium silicate piping insulation with presized glass cloth. Jacket may be field or factory applied. Securely cement jackets, flaps and bands in place with adhesive. Overlap jacket not less than 1-1/2 inch. Butt joint jacketing bands not less than 4 inch wide.
- c. Fabricate fittings from segmented pipe insulation sections, bed in insulating cement and wire in place. Fill voids with insulating cement and provide 1/4 inch thick final coating. Impregnate glass lagging tape with adhesive, wrap on a 50% overlap basis and blend tape smoothly into adjacent jacketing. Apply additional adhesive as required for smooth contour.
- d. Finish exposed-to-view insulation with a 6 mil dry film of coating. Color as selected by the ARCHITECT-ENGINEER.
- e. Thermally insulate and sound isolate pressure regulating station piping and all valve and flange surfaces for a distance of 10 pipe diameters upstream of the station and 10 pipe diameters downstream of the first elbow downstream of the station with specified thickness of calcium silicate and lead sheeting. Prior to application of insulation jacketing, apply 1/64 inch thick lead sheet per recommendations of the Lead Industries Association. Insulation may be applied in two layers with lead sheet taped between layers.

4. **RAIN CONDUCTORS**

- a. Insulate nonvertical pipe and fittings including connection to roof or area drain body.

5. **ROOF DRAIN SUMP AND ROOF DRAIN PAN**

- a. Attach insulation by mechanical means and with adhesive. Insulate roof drain body in a vapor tight manner.

6. **SANITARY WASTE NONVERTICAL ABOVEGROUND PIPING**

- a. Insulate nonvertical pipe, fittings and miscellaneous surfaces in areas where damage from dripping condensate might occur over finished areas.

C. **Air Handling System Surfaces**

1. On rectangular surfaces 10 inches or less wide apply the insulation with adhesive to the top, sides, and bottom of the duct. On rectangular surfaces more than 16 inches wide apply the insulation with adhesive to the top, side, impaled on pins stud welded to the bottom. Apply sufficient pins to the bottom to insure contact of the insulation with the sheet metal. Install speed nuts or clips to the pins. Where the pins have perforated the vapor seal facing, cut the pins close to the speed nuts and apply a patch of vapor seal tape to restore the vapor seal.
2. Apply adhesive to contact surfaces between the insulation and the metal. Furnish brush-on fire proof type adhesives. Butt insulation sheets together firmly, tape joints with a vapor barrier tape, and cement down facing tabs.

D. **Air Handling Systems Components And Equipment To Receive Rigid Fibrous Glass**

1. Fasten insulation hangers to outside of metal surface on 12 inch centers in both directions using hanger adhesive or weld on hangers using weld pin technique. Impale insulation over

- hangers. Seal over fasteners with indoor vapor barrier coating or matching pressure sensitive tape patches. Apply top and bottom panels to lap side panels. Lap insulation boards at corners and seal joints with vapor barrier tape set in vapor barrier lap adhesive.
2. Terminate and seal the insulation where thermometers, controls, linkages, flexible connections, test connections and access doors occur in the ductwork so as not to interfere with their function or replacement. Seal terminating edges of insulation with indoor vapor barrier coating.
 3. Single sheet access doors and access panels shall be insulated separately so as to be operable. Vapor seal insulation edges with indoor vapor barrier coating.
 4. Concealed - no further finish required.
 5. Exposed - no further finish required.

E. Jackets

1. Overlap joints 2 inches and for outdoor installation include joint sealant. Fittings jackets shall be two piece of the same material as the jacket or when approved by the ARCHITECT-ENGINEER for indoor use may be PVC or molded or routed fiberglass. Indoor piping installed within 8'-0" of floor shall be covered with an aluminum jacket.
2. Where indicated on the DRAWINGS cover insulated Cooling Tower Water piping with stainless steel jacket.

3.3 FIELD QUALITY CONTROL

A. Testing

1. When testing insulation conductance at any point, consider insulation conductance required by the SPECIFICATIONS as maximum, not average. If insulation conductance is found by test to exceed the stipulated maximum, either replace or add additional and complete insulation and finishing to bring system to the required maximum conductance.

END OF SECTION

Revision History	
Date	Rev. No.
A	0
B	0
C	0
D	0
E	0
F	0
02-19-09	0

LMS/djo

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